

CLAIMS:

1. A remote sensing unit for collecting data for identifying a substance, the remote sensing unit comprising:

- 5 a position-determining mechanism adapted to determine a geographic location of the remote sensing unit;  
an imaging device adapted to generate a magnified image of the substance;  
and  
a first transmitter adapted to transmit the geographic location and the magnified image.

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2. The remote sensing unit as set forth in claim 1, wherein the position-determining mechanism includes a global positioning system receiver.

3. The remote sensing unit as set forth in claim 1, wherein the imaging  
15 device includes a digital microscope.

4. The remote sensing unit as set forth in claim 1, wherein the transmitter is adapted to allow for selecting between a wireless manner of communication and a hardwired manner of communication.

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5. The remote sensing unit as set forth in claim 1, further including a sample examination cassette including -

- 25 a roll of filter paper for receiving the substance;  
a roll of film providing an impermeable barrier for isolating the substance; and  
an archive spool for collecting the roll of filter paper and the roll of film.

6. The remote sensing unit as set forth in claim 1, further including a mass spectrometer adapted to allow for investigating gaseous substances, wherein the mass spectrometer provides an output, with the transmitter being further adapted to  
30 transmit the output along with the geographic location and the magnified image.

7. The remote sensing unit as set forth in claim 1, further including a multiple reagent and sample treatment module adapted to allow for performing micro-chemical and biological testing of the substance, wherein the multiple reagent and sample treatment module provides an output, with the transmitter being further  
5 adapted to transmit the output along with the geographic location and the magnified image.

8. The remote sensing unit as set forth in claim 7, wherein the multiple reagent and sample treatment module is remotely controllable to allow for manually  
10 controlling the micro-chemical and biological testing.

9. The remote sensing unit as set forth in claim 1, further including a control module adapted to allow for remotely controlling operation of the imaging device.  
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10. The remote sensing unit as set forth in claim 1, further including a temperature sensor, a wind speed/direction sensor, and a rain sensor that provide an output, with the transmitter being further adapted to transmit the output along with the geographic location and the magnified image.  
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11. The remote sensing unit as set forth in claim 1, further including a radiation sensor adapted to measure a background radiation and provide an output, with the transmitter being further adapted to transmit the output along with the geographic location and the magnified image.  
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12. The remote sensing unit as set forth in claim 1, further including one or more sensors selected from the group consisting of: GC/MS sensors, acoustic sensors, visual sensors, movement sensors, seismic sensors, magnetic sensors, and solar sensors, wherein each of the sensors is adapted to provide an output, with the  
30 transmitter being further adapted to transmit the output along with the geographic location and the magnified image.

13. The remote sensing unit as set forth in claim 12, further including an open architecture that allows for removing and replacing the one or more sensors without rebooting the remote sensing unit.

5 14. The remote sensing unit as set forth in claim 1, wherein the remote sensing unit is adapted to engage in grid computing with one or more other computing resources.

10 15. The remote sensing unit as set forth in claim 1, further including a self-righting mechanism adapted to substantially ensure a proper operating orientation of the remote sensing unit.

15 16. The remote sensing unit as set forth in claim 15, wherein the self-righting mechanism involves a substantially spherical shape of the remote sensing unit and an offset center of gravity.

20 17. The remote sensing unit as set forth in claim 16, wherein the substantially spherical shape is achieved by an inflatable balloon associated with an exterior of the remote sensing unit.

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18. A remote sensing unit for identifying a substance, the system comprising:

- a position-determining mechanism adapted to determine a geographic location of the remote sensing unit;
- 5 an imaging device adapted to generate a magnified image of the substance;
- an image analysis and recognition component adapted to substantially automatically compare the magnified image to a plurality of reference images associated with known substances and thereby attempt to identify the substance based upon similarities between the magnified
- 10 image of the substance and one or more of the plurality of reference images; and
- a transmitter adapted to transmit the geographic location, the magnified image, and the identification of the substance by the image analysis and recognition component.

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19. The remote sensing unit as set forth in claim 18, wherein the position determining mechanism includes a global positioning system receiver.

20. The remote sensing unit as set forth in claim 18, wherein the imaging  
20 device includes a digital microscope.

21. The remote sensing unit as set forth in claim 18, wherein the transmitter is adapted to allow for selecting between a wireless manner of communication and a hardwired manner of communication.

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22. The remote sensing unit as set forth in claim 18, further including a sample examination cassette including -

- a roll of filter paper for receiving the substance;
- a roll of film providing an impermeable barrier for isolating the substance; and
- 30 an archive spool for collecting the roll of filter paper and the roll of film.

23. The remote sensing unit as set forth in claim 18, further including a mass spectrometer adapted to allow for investigating gaseous substances, wherein the mass spectrometer provides an output, with the transmitter being further adapted to transmit the output along with the geographic location and the magnified image.

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24. The remote sensing unit as set forth in claim 18, further including a multiple reagent and sample treatment module adapted to allow for performing micro-chemical and biological testing of the substance, wherein the multiple reagent and sample treatment module provides an output, with the transmitter being further adapted to transmit the output along with the geographic location and the magnified image.

25. The remote sensing unit as set forth in claim 24, wherein the multiple reagent and sample treatment module is remotely controllable to allow for manually controlling the micro-chemical and biological testing.

26. The remote sensing unit as set forth in claim 18, further including a control module adapted to allow for remotely controlling operation of the imaging device.

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27. The remote sensing unit as set forth in claim 18, further including a temperature sensor, a wind speed/direction sensor, and a rain sensor that provide an output, with the transmitter being further adapted to transmit the output along with the geographic location and the magnified image.

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28. The remote sensing unit as set forth in claim 18, further including a radiation sensor adapted to measure a background radiation and provide an output, with the transmitter being further adapted to transmit the output along with the geographic location and the magnified image.

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29. The remote sensing unit as set forth in claim 18, further including one or more sensors selected from the group consisting of: GC/MS sensors, acoustic sensors, visual sensors, movement sensors, seismic sensors, magnetic sensors, solar sensors, wherein each of the sensors is adapted to provide an output, with the transmitter being further adapted to transmit the output along with the geographic location and the magnified image.

30. The remote sensing unit as set forth in claim 29, further including an open architecture that allows for removing and replacing the one or more sensors without rebooting the remote sensing unit.

31. The remote sensing unit as set forth in claim 18, wherein the remote sensing unit is adapted to engage in grid computing with one or more other computing resources.

32. The remote sensing unit as set forth in claim 18, further including a self-righting mechanism adapted to substantially ensure a proper operating orientation of the remote sensing unit.

33. The remote sensing unit as set forth in claim 32, wherein the self-righting mechanism involves a substantially spherical shape of the remote sensing unit and an offset center of gravity.

34. The remote sensing unit as set forth in claim 33, wherein the substantially spherical shape is achieved by an inflatable balloon associated with an exterior of the remote sensing unit.

35. A system for identifying a substance, the system comprising:  
a remote sensing unit including -  
a position-determining mechanism adapted to determine a geographic  
location of the remote sensing unit,  
5 an imaging device adapted to generate an image of the substance,  
and  
a first transmitter adapted to transmit the geographic location and the  
image; and  
a control unit including -  
10 a receiver adapted to receive the geographic location and the image  
transmitted by the remote sensing unit,  
an image analysis and recognition component adapted to substantially  
automatically compare the image to a plurality of reference  
images associated with known substances and thereby attempt  
15 to identify the substance based upon similarities between the  
image of the substance and one or more of the reference  
images, and  
one or more second transmitters adapted to transmit a report including  
the geographic location of the remote sensing unit, the image,  
20 and the identification of the substance by the image analysis  
and recognition component.

36. The system as set forth in claim 35, wherein the remote sensing unit  
further includes a multiple reagent and sample treatment module adapted to allow  
25 for performing micro-chemical and biological testing of the substance.

37. The system as set forth in claim 36, wherein the multiple reagent and  
sample treatment module is remotely controllable by the control unit to allow for  
manually controlling the micro-chemical and biological testing, wherein the multiple  
30 reagent and sample treatment module generates an output that is transmitted to the  
control unit.

38. The system as set forth in claim 35, wherein the remote sensing unit further includes a control module adapted to allow for remotely controlling operation of the imaging device from the control unit.

5        39. The system as set forth in claim 35, wherein the control unit includes at least two transmitters, including a preferred primary transmitter and a secondary transmitter.

40. The system as set forth in claim 39, wherein the primary transmitter  
10 uses cellular telephone technology.

41. The system as set forth in claim 39, wherein the secondary transmitter uses satellite-based communication technology.

15        42. The system as set forth in claim 35, wherein the control unit is adapted to engage in grid computing with other computing resources to solve complex processing problems.

43. The system as set forth in claim 35, further comprising one or more  
20 remote data processing and storage servers for receiving the report and making the report available to authorized persons via a wide area network.

44. The system as set forth in claim 43, wherein the one or more data processing and storage servers are provided with evaluation tools for evaluating the  
25 report in light of other reports and other relevant data.

45. The system as set forth in claim 43, wherein the one or more data processing and storage servers are adapted to engage in grid computing with other computing resources.  
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46. A system for identifying a substance, the system comprising:  
a remote sensing unit including -  
a position-determining mechanism adapted to determine a geographic  
location of the remote sensing unit,  
5 a data collection mechanism adapted to collect data for identifying the  
substance, and  
a transmitter adapted to transmit the geographic location and the data  
collected by the data collection mechanism; and  
a control unit including -  
10 a receiver adapted to receive the geographic location and the data  
transmitted by the remote sensing unit,  
a display and user interface adapted to allow an operator of the control  
unit to view the geographic location and the data,  
a primary transmitter adapted to allow for communicating a report  
15 including the geographic location and the data over a network  
via a first type of communications link, and  
a secondary transmitter adapted to allow for communicating the report  
over the network via a second type of communications link.
- 20 47. The system as set forth in claim 46, wherein the data collection  
mechanism includes a multiple reagent and sample treatment module adapted to  
allow for performing micro-chemical and biological testing of the substance.
48. The system as set forth in claim 47, wherein the multiple reagent and  
25 sample treatment module is remotely controllable by the control unit to allow for  
manually controlling the micro-chemical and biological testing.
49. The system as set forth in claim 46, wherein the control unit includes  
at least two transmitters, including a preferred primary transmitter and a secondary  
30 transmitter.

50. The system as set forth in claim 49, wherein the primary transmitter uses cellular telephone technology.

51. The system as set forth in claim 49, wherein the secondary transmitter  
5 uses satellite-based communication technology.

52. The system as set forth in claim 46, wherein the control unit is adapted to engage in grid computing with other computing resources.

10 53. The system as set forth in claim 46, further comprising one or more remote data processing and storage servers for receiving the report and making the report available to authorized persons via a wide area network.

54. The system as set forth in claim 53, wherein the one or more data  
15 processing and storage servers are provided with evaluation tools for evaluating the report in light of other reports and other relevant data.

55. The system as set forth in claim 53, wherein the one or more data  
processing and storage servers are adapted to engage in grid computing with other  
20 computing resources.

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56. A system for identifying a substance, the system comprising:  
a remote sensing unit including -  
a position-determining mechanism adapted to determine a geographic  
location of the remote sensing unit,  
5 an imaging device adapted to generate an image associated with the  
substance,  
an image analysis and recognition component adapted to substantially  
automatically compare the image to a plurality of reference  
images associated with known substances and thereby attempt  
10 to identify the substance based upon similarities between the  
image of the substance and one or more of the plurality of  
reference images, and  
a transmitter adapted to transmit the geographic location, the image,  
and the identification of the substance by the image analysis  
15 and recognition component; and  
a control unit including -  
a receiver adapted to receive the geographic location, the image, and  
the identification of the substance transmitted by the remote  
sensing unit,  
20 a display and user interface adapted to allow an operator of the control  
unit to view the geographic location, the image, and the  
identification of the substance,  
a primary transmitter adapted to allow for communicating a report  
including the geographic location, the image, and the  
25 identification of the substance over a network via a first type of  
communications link, and  
a secondary transmitter adapted to allow for communicating the report  
over the network via a second type of communications link.
- 30 57. The system as set forth in claim 56, wherein the remote sensing unit  
further includes a multiple reagent and sample treatment module adapted to allow  
for performing micro-chemical and biological testing of the substance.

58. The system as set forth in claim 56, wherein the multiple reagent and sample treatment module is remotely controllable by the control unit to allow for manually controlling the micro-chemical and biological testing, wherein the multiple reagent and sample treatment module generates an output that is transmitted to the  
5 control unit.

59. The system as set forth in claim 56, wherein the remote sensing unit further includes a control module adapted to allow for remotely controlling operation of the imaging device from the control unit.  
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60. The system as set forth in claim 56, wherein the control unit includes at least two transmitters, including a preferred primary transmitter and a secondary transmitter.

15 61. The system as set forth in claim 60, wherein the primary transmitter uses cellular telephone technology.

62. The system as set forth in claim 60, wherein the secondary transmitter uses satellite-based communication technology.  
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63. The system as set forth in claim 56, wherein the control unit is adapted to engage in grid computing with other computing resources.

64. The system as set forth in claim 56, further comprising one or more  
25 remote data processing and storage servers for receiving the report and making the report available to authorized persons via a wide area network.

65. The system as set forth in claim 64, wherein the one or more data processing and storage servers are provided with evaluation tools for evaluating the  
30 report in light of other reports and other relevant data.

66. The system as set forth in claim 64, wherein the one or more data processing and storage servers are adapted to engage in grid computing with other computing resources.

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